NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

MBA PROFESSIONAL REPORT

A Study of the Concept and Implementation of the Lead Systems Integrator in Defense Acquisitions

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December 2007

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REPORT DOCUMENTATION PAGE			*Form Approved OMB No. 0704-0188*
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.			
1. AGENCY U.S.E ONLY *(Leave blank)*	**2. REPORT DATE** December 2007	**3. REPORT TYPE AND DATES COVERED** MBA Professional Report	
4. TITLE AND SUBTITLE A Study of the Concept and Implementation of the Lead Systems Integrator in Defense Acquisitions			**5. FUNDING NUMBERS**
6. AUTHOR(S) Harriott, Omar A., Santamaria, Paul F.			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			**8. PERFORMING ORGANIZATION REPORT NUMBER**
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			**10. SPONSORING/MONITORING AGENCY REPORT NUMBER**
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.			
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited			**12b. DISTRIBUTION CODE**

13. ABSTRACT (maximum 200 words)

The purpose of the Lead Systems Integrator (LSI) approach is to introduce more-streamlined industrial practices and state-of-the-industry technology into Government acquisition. The LSI is designed to assist the Government in analyzing requirements and managing the development of system-of-systems for acquisition programs. The purpose of this study is to analyze the Lead Systems Integrator (LSI) concept and how it facilitates defense system development and acquisition. This research project evaluated the concept of the LSI by examining its use in the Army's Future Combat Systems and the Coast Guard's Deepwater programs. These two force-modernization programs are composed of a complex system-of-systems design acquired through a LSI. This report clearly defines the LSI and the conceptual concerns surrounding its implementation, as well as describes the Army's Future Combat Systems and the Coast Guard's Deepwater Programs' experiences with the LSI.

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14. SUBJECT TERMS Lead Systems Integrator, Future Combat Systems, Deepwater			**15. NUMBER OF PAGES** 77
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	**18. SECURITY CLASSIFICATION OF THIS PAGE** Unclassified	**19. SECURITY CLASSIFICATION OF ABSTRACT** Unclassified	**20. LIMITATION OF ABSTRACT** UU

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18

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A STUDY OF THE CONCEPT AND IMPLEMENTATION OF THE LEAD SYSTEMS INTEGRATOR IN DEFENSE ACQUISITIONS

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Submitted in partial fulfillment of the requirements for the degree of

MASTER OF BUSINESS ADMINISTRATION

from the

NAVAL POSTGRADUATE SCHOOL
December 2007

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A STUDY OF THE CONCEPT AND IMPLEMENTATION OF THE LEAD SYSTEMS INTEGRATOR IN DEFENSE ACQUISITIONS

ABSTRACT

The purpose of the Lead Systems Integrator (LSI) approach is to introduce more-streamlined industrial practices and state-of-the-industry technology into Government acquisition. The LSI is designed to assist the Government in analyzing requirements and managing the development of system-of-systems for acquisition programs. The purpose of this study is to analyze the Lead Systems Integrator (LSI) concept and how it facilitates defense system development and acquisition. This research project evaluated the concept of the LSI by examining its use in the Army's Future Combat Systems and the Coast Guard's Deepwater programs. These two force-modernization programs are composed of a complex system-of-systems design acquired through a LSI. This report clearly defines the LSI and the conceptual concerns surrounding its implementation, as well as describes the Army's Future Combat Systems and the Coast Guard's Deepwater Programs' experiences with the LSI.

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LIST OF ACRONYMS

BCT	: Brigade Combat Team
C2V	: Command and Control Vehicle
C4ISR	: Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance
CDR	: Critical Design Review
CMP	: Common Mobility Platform
COP	: Common Operational Picture
CTD	: Concept and Technology Development
DARPA	: Defense Advanced Research Projects Agency
DHS	: Department of Homeland Security
DoD	: Department of Defense
DT	: Department of Transportation
EADS	: European Aeronautic Defence and Space Company
FAR	: Federal Acquisition Regulation
FCS	: Future Combat Systems
FFRDC	: Federally Funded Research and Development Center
FRC	: Fast Response Cutter
HMWWV	: High Mobility Multipurpose Wheeled Vehicle
ICGS	: Integrated Coast Guard Systems
ICV	: Infantry Carrier Vehicle
IPPD	: Integrated Product and Process Development
IPT	: Integrated Product Team
JTRS	: Joint Tactical Radio System
LRI	: Long-range Interceptor
LRS	: Long-range Search Aircraft
LSI	: Lead Systems Integrator
MCH	: Multi-mission Cutter Helicopter
MCS	: Mounted Combat System
MDAP	: Major Defense Acquisition Program

MRR	: Medium-range Recovery Helicopter
MRS	: Medium-range Surveillance Patrol Aircraft
MULE	: Multifunctional Utility/Logistics and Equipment
NSC	: National Security Cutter
OCI	: Organizational Conflict of Interest
OTA	: Other Transaction Authority
PAT	: Principal-Agent Theory
PM	: Program Manager
RST	: Reconnaissance, Surveillance and Target Acquisition
SAIC	: Science Applications International Corporation
SDD	: System Development and Demonstration
SoS	: System-of-Systems
SRI	: Short-range Interceptor
SRP	: Short-range Prosecutor
SUGV	: Small Unmanned Ground Vehicle
UA	: Unit of Action
UAV	: Unmanned Aerial Vehicle
UGS	: Unmanned Ground Sensor
UGV	: Unmanned Ground Vehicle
VUAV	: Vertical Take-off and Landing Unmanned Aerial Vehicle
WIN-T	: Warfighter Information Network-Tactical

ACKNOWLEDGEMENTS

We express our sincerest gratitude to the faculty of the Naval Postgraduate School for their guidance, insight and knowledge. Their experiences and teachings have helped us become better leaders and professionals. We thank our advisors whose patience, guidance and leadership have helped us complete this project

We would like to thank the personnel in the Army FCS and Coast Guard Deepwater offices, particularly COL Raymond Jones (USA), Mr. Robert Halle and Mr. Joseph Milligan for providing us the data for our research.

Most importantly, we would like to thank our families for their unwavering support throughout our time here at NPS. We could not have achieved much here without their encouragement and understanding. They are truly our motivation and inspiration.

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I. INTRODUCTION

A. PURPOSE

The purpose of this research is to analyze the Lead Systems Integrator (LSI) concept and how it facilitates defense system development and acquisition. The data for this analysis are from one Major Defense Acquisition Program (MDAP) and one Department of Homeland Security (DHS) acquisition program, both described below.

B. BACKGROUND

This project describes the Lead Systems Integrator concept through the experiences of two acquisition programs: the Army's Future Combat Systems and the Coast Guard's Deepwater program. The LSI can be described as a contractor hired by the Government to oversee the design, development and procurement of large system-of-systems programs. The contractor holds inherently governmental authority in order to manage the program's cost, schedule, and performance variables. The LSI's authority gives it great latitude in ensuring seamless integration of information and technologies. However, this authority also can be a potential risk, as the LSI is a corporate entity whose interests may not coincide with the best interests of the Government. The organizational conflicts of interest between the LSI and the Government, due to its corporate (i.e., profit seeking) nature, may erode the integrity of information passed on to the customer and lead to less than optimal decisions. While these sociological factors are inherent in all contractual arrangements, they pose a greater risk with a LSI due to the large and complex nature of these programs.

1. Army's Future Combat Systems

The Army's Future Combat Systems (FCS) is a force modernization program that exploits the benefits of private-sector business practices. FCS is the Army's largest force-modernization program to date, consisting of a multitude of manned and unmanned ground vehicles, unmanned aerial vehicles and a complex communications network that links all systems to ensure operational integration in a system-of-systems architecture. A system-of-systems can be described as an arrangement or a set of systems that are interconnected to provide a capability. The system-of-systems is composed of individual modules, and the removal of one or more modules will cause the total system performance to degrade. This program's complexity led the Army to utilize the LSI concept. It believed private industry's knowledge of system design and development would provide the best solutions for its needs.

2. Coast Guard Deepwater Program

The Coast Guard's Deepwater program is designed to modernize the Coast Guard's aging fleet of deepwater assets with new cutters, aircraft and command and control capabilities. The Deepwater program is the Coast Guard's largest modernization program to date. The program is designed to utilize a system-of-systems acquisition approach in that the acquisition efforts are focused on acquiring capabilities rather than platforms. Much like the Army's FCS, the complexity of the Deepwater program led the Coast Guard to utilize the LSI concept in order to provide a seamless integration of new technologies.

C. RESEARCH QUESTIONS

1. Primary Research Question

The primary research question is:

- What is the concept of the Lead Systems Integrator?

2. Supplemental Research Questions

The supplemental research questions are:

- How could the conceptual approach of the LSI increase the Government's probability of attaining the best-value?

- How effective was the implementation of the LSI — based upon cost, schedule, and performance?

D. SCOPE

This project analyzes the LSI implementation for two separate programs under two different Government organizations. It provides a detailed background and historical perspective on the development of both programs and how the LSI has been integrated into them. This project analyzes the perceived effectiveness of the LSI from the viewpoints of cost, schedule and performance.

E. METHODOLOGY

The research methodology for this study included reviews of documents produced by the Department of Defense (DoD), Department of Homeland Security (DHS) and U.S. Government reports related to the LSI, Deepwater and FCS programs. We analyzed these documents to clarify the LSI concept. In conjunction with data from these documents, we also closely examined the program contracts in order to understand and evaluate the implementation of the LSI within the two programs. In addition, we conducted interviews with personnel from both the FCS and Deepwater programs, as appropriate, so that we could incorporate their views into our analysis.

F. BENEFITS OF RESEARCH

The benefits of this research are the formulation of a descriptive definition of the LSI; a fundamental understanding of the degree to which the LSI can facilitate Defense system development and acquisition; and an evaluation of the performance of the LSI based upon two actual programs. The definition of the LSI will describe what a LSI consists of and what its actual responsibilities are. The fundamental understanding of the LSI will allow the reader to recognize the potential benefits and pitfalls of using this approach in Government acquisitions. The assessment of the LSI's performance, using quantitative data on cost, schedule, and performance in both the Army and Coast Guard programs, will give the reader an evaluation of the LSI in real-world applications and not just in theory.

G. ORGANIZATION

The study is organized as follows:

- Chapter I: Introduction—Addresses the scope of the project, identifies our methodology, presents research questions, and states the benefits of this research.
- Chapter II: Lead Systems Integrator Concept —Defines the Lead Systems Integrator, the rationale that led to its implementation and the potential pitfalls of this acquisition approach.
- Chapter III: The Army's Future Combat System—Provides a history and description of the Army's Future Combat Systems, as well as the program's contract history.
- Chapter IV: The Deepwater Program—Provides a history and description of the Coast Guard's Deepwater Program, as well as the program's contract history.
- Chapter V: Lead Systems Integrator Implementation—Provides quantitative data to show the strengths and weaknesses of the LSI concept.
- Chapter VI: Summary, Conclusion, and Recommendations—Evaluates the data in Chapters II through V and discusses recommendations for further research.

II. LEAD SYSTEMS INTEGRATOR CONCEPT

A. INTRODUCTION

This chapter explains the Lead Systems Integrator (LSI) concept in the context of the Army's FCS Program and the Coast Guard's Deepwater Program. An LSI can be described as a contractor hired by the Government to oversee the design, development and procurement of a large system-of-systems. The LSI is given substantial authority to perform program management tasks that Government entities have traditionally performed.

This chapter presents the definition of a LSI according to the National Defense Authorization Act of 2006, as well as a practical definition that has evolved out of the application of the LSI concept. The description of the system-of-systems concept provides the reader with the necessary background for understanding why a LSI was considered to be the optimal acquisition approach for a system-of-systems. The system integrator role in a system-of-systems is also described in order to clarify the duties of an LSI. The chapter also explains each of the program's reasons for choosing a LSI acquisition approach, as well as the reasons that any Government entity would choose a LSI for a large acquisition program. The chapter ends with a sociological analysis of the LSI concept, as well as a presentation of potential challenges of implementing an LSI.

B. DEFINITION OF THE LSI

The definition of the LSI concept has gone through many iterations, leading to misunderstandings of the LSI's responsibilities. Thus, it is necessary to adequately define key terms to clarify the LSI concept.

1. Lead Systems Integrator

The Fiscal Year 2006 National Defense Authorization Act defines two types of LSIs:

- Prime contractors who develop major systems and who are expected at the time of the contract award to perform a substantial portion of the work on the system and major subsystems.

- Contractors who perform acquisition functions that are inherently governmental in the development of a major system (Grasso 2).

a. Prime Contractors

The first portion of this definition addresses the LSI as a prime contractor for a large system. The specification of the amount of work the prime contractor performs is a safeguard to ensure that a contractor does not outsource all work, failing to maintain proper quality-control and acquisition procedures. Thus, one might believe that a LSI does not necessarily subcontract out the majority of the work for a system. However, our research shows that the LSIs for the FCS program and the Deepwater program actually do subcontract a majority of the work. Therefore, this aspect of the definition is not applicable to FCS's and Deepwater's LSIs.

b. Inherently Governmental

The second part of the LSI definition addresses the LSI as a contractor who performs inherently governmental activities. The Office of Management and Budget Circular A-76 gives a broad description of what is inherently governmental. An inherently governmental activity is any activity that affects the ability of the federal Government to use discretion in decision making.

> While inherently governmental activities require the exercise of substantial discretion, not every exercise of discretion is evidence that an activity is inherently governmental. Rather, the use of discretion shall be deemed inherently governmental if it commits the Government to a course of action when two or more alternative courses of action exist and decision making is not already limited or guided by existing policies, procedures, directions, orders, and other guidance that (1) identify specified ranges of acceptable decisions or conduct and (2) subject the discretionary authority to final approval or regular oversight by agency officials. (Executive Office of the President and Office of Management and Budget A.2)

The important aspect of this definition is that an inherently governmental action is not necessarily the decision-making action, but, rather, the ability to influence the decision-maker's judgment. The LSI concept, as it was utilized in the two subject programs in this analysis, is more closely correlated with this aspect of the LSI definition than with the first.

In order to oversee the design and development of a system-of-systems, the LSI must have intimate knowledge of the systems being developed and how they will be integrated with each other. The Government agency relies on the LSI's knowledge and expertise to make program-related decisions. This dependence on the LSI can create a situation in which the LSI has extensive influence over the direction the program may take and uses its influence to adversely affect Government decision-making. It is the use of its extensive influence that gives it an inherently governmental role.

The FCS and Deepwater programs are both system-of-systems programs requiring complex integration activities. The complex nature of both programs drove the Army and the Coast Guard to adopt a LSI approach that would confer inherently governmental tasks to the awarded contractor(s). In essence, the programs were prime candidates for a LSI because they were considered too large and complex to manage otherwise.

The Fiscal Year 2006 National Defense Authorization Act's definition of the LSI has served as its standard formal definition. However, this definition fails to address the key components and characteristics of a LSI as it pertains to the two subject programs in this research. This research defines the LSI as follows:

- Contractors who are responsible for system integration of system-of-systems acquisition programs, and
- Contractors who perform inherently governmental activities in managing system-of-systems acquisition programs.

C. SYSTEM OF SYSTEMS

Our modification of the LSI definition addresses the system-of-systems characteristic of the programs associated with an LSI. It is important to understand the system-of-systems concept in order to properly ascertain the duties of the LSI. The concept of the LSI grew out of the perceived necessity to successfully acquire large-scale system-of-systems acquisition programs. While there is no universally accepted definition of a system-of-systems, this phenomenon is widespread across many different industries, ranging from air defense networks to commuter transportation systems (Manthorpe Jr. 305–310). The definition of a system-of-systems used for this analysis is as follows:

> A set or arrangement of interdependent systems that are related or connected to provide a given capability. The loss of any part of the system will significantly degrade the performance or capabilities of the whole. (Defense Acquisition University 1)

The two programs used for these analyses are system-of-systems acquisition programs because they are not simply composed of a single weapon platform or a piece of machinery, but of an inter-networked system that operates congruently to provide a war-fighter capability. LSIs are contractors (and, in many cases, teams of contractors) who work with the Government to manage the development and creation of these systems to ensure that the various component systems interact effectively. Their duties are far-reaching in that LSIs possess substantial authority to define and execute these programs. The duties of the LSI may include requirements generation, technology development, source selection, procurement of systems, testing, validation and management of suppliers and sub-contractors (Grasso).

A system-of-systems requires a large amount of compatibility among its sub-systems to ensure integration. The integration of all systems is a pivotal activity in the successful acquisition of a system-of-systems. Because the Army and the Coast Guard were unable to accommodate the integration workload of large system-of-systems, they adopted the Lead Systems Integrator approach to facilitate the seemingly insurmountable managerial effort needed.

D. SYSTEMS INTEGRATOR

We discuss the role of the systems integrator in order to describe the typical duties of a LSI from a systems engineering perspective. The *Handbook of Systems Engineering and Management* states that systems integration plays a critical role in system development. Specifically, the systems integrator must be involved in "interpreting the overall performance needs of a sponsor into technical performance specifications and ensuring that these system requirements are met" (Palmer 483). This interpretation of overall performance needs is analogous to requirements refinement in Government acquisitions. However, the LSI has the latitude to determine requirements at a much higher level than has been previously afforded any traditional prime contractor. A traditional prime contractor is normally given a requirement for an asset, such as a tank, aircraft or artillery system. The FCS and Deepwater programs have overarching requirements for capability needs—as opposed to asset or platform needs—and, therefore, depend heavily on the LSI to refine requirements in order to fulfill their capability needs with assets and platforms.

The systems integration role in large, complex engineered systems must provide an "organized, sensible, accountable, and workable approach to otherwise seemingly incomprehensible programs" (Palmer 483). This aspect of the systems integration role deals in large part with managing complexity. The FCS and Deepwater programs are both considered large, complex modernization efforts by their respective departments. The integration of the many systems in these programs into a system-of-systems architecture is where the complexity lies. The systems integrator should ideally manage the complexity of a program by performing the following functions:

- Develop and utilize a strategic plan for management and technical aspects of the program.
- Establish a complete audit trail.
- Assist in meeting initially unrecognized needs (including changes in system requirements).

- Avoid under- and over-procurement.
- Develop and utilize risk-management plans.
- Manage subcontractors to the same specifications employed by the prime contract.
- Provide for future modifications and expansions. (Palmer 483)

E. WHY THE LEAD SYSTEMS INTEGRATOR WAS CHOSEN

Due to the complexities inherent in a system-of-systems architecture, both services chose to use a cooperative acquisition approach in order to successfully develop and acquire their respective programs in a timely manner. There are three main reasons why the Government chose a LSI for these programs:

- The program is complex.
- The service has inadequate acquisition capability.
- The Government entity wishes to encourage competition.

1. Program Complexity

The LSI for the FCS program was to provide the necessary system engineering and program management skills to develop, procure and integrate all systems in the program. Some of the key technological developments of the program are provided below as an example of the complexity associated with the FCS program.

- The 14 major weapon systems or platforms have to be designed and integrated simultaneously and within strict size and weight limitations.
- At least 46 technologies that are considered crucial to achieving critical performance capabilities will need to be matured and integrated into the system of systems.
- The development, demonstration, and production of as many as 170 complementary systems and associated programs must be synchronized with FCS content and schedule. This will also involve developing about

100 network interfaces so that the FCS can be interoperable with other Army and joint forces.

- The program requites the creation of an estimated 63 million lines of software code, more than three times the number being developed for the Joint Strike Fighter program. (Francis, "Role of the Lead Systems Integrator" 7)

The initial plans for the FCS forecasted the development being complete in five-and-a-half years, a much shorter period than the Army typically requires to complete development of just one system using traditional acquisition methods and capabilities (Francis, "Role of the Lead Systems Integrator"). The complexities inherent in the FCS program, along with the accelerated schedule and the lack of maturity in key technologies, were risks that the Army hoped to mitigate by using a LSI. To address the technology maturity issues and bring superior strategies and solutions to the development of the FCS, the LSI would use more adaptive organizational and manpower techniques than the Army would.

The Deepwater program had similar complexity issues, associated mainly with the interoperability aspect of the program. The assets in the Deepwater program, including the command and control and logistics support systems, would all be procured in a single integrated package. The Coast Guard had never before attempted this type of procurement. The scope of the program involved developing multiple platforms—both maritime and aerial—simultaneously to ensure interoperability among assets. The Deepwater program's focus was on a system-of-systems approach for acquiring capabilities, and in order to accommodate the complexity of a system-of-systems approach, the Coast Guard used a LSI.

2. Inadequate Acquisition Capability

Throughout the years 1994-2005, acquisition initiatives reduced the DoD acquisition workforce by more than 50 percent (Grasso). This left a void of capability in defense acquisitions, which the Army viewed as limiting its ability to execute the necessary systems integration tasks for the FCS program with its own acquisition personnel. The program's short timeline and its complexity led to the following assessment of the shortfalls in acquisition manpower:

- the inability to cross traditional organizational boundaries
- a shortage in key skill sets: namely the skills required to develop the information network
- insufficient resources to properly man and staff the many program offices needed to manage the program. (Flood)

A systems integrator for a system-of-systems would need to function across a variety of organizational boundaries. This is especially important when refining requirements and designing solutions for user capability needs. The integrator must be able to work across the entire spectrum of war-fighting communities, such as aviation, infantry, armor and field artillery. The Army Acquisition Corps lacked the experience in coordinating developmental efforts among the war-fighting communities. (Francis, "Role of the Lead Systems Integrator"). The FCS is the first program to integrate all war-fighting assets into a system-of-systems from inception. The legacy stovepipe process of developing systems independently was inadequate for FCS. LSIs could easily work through the organizational boundaries because they are not part of the Army organization and have no problem "stepping on toes" in order to coordinate; thus, there would be few professional ramifications on their end. The LSI facilitates the coordination between user and developer in much the same way.

The majority (approximately 95 percent) of the FCS's performance depends on software (Francis, "Role of the Lead Systems Integrator"). The Army had sufficient expertise in developing weaponry such as tanks, artillery pieces and infantry fighting vehicles from years of experience. However, the software and network development effort of the FCS program is significant, and integrating the development of the platforms with the network and software is critical. The Army did not have the sufficient expertise in software engineering to adequately manage a program of FCS's magnitude. The software is estimated to be approximately 63 million lines of code, and though lines of code can be a deceiving metric for measuring software effort, it is still far larger than any other Army acquisition program.

If the Army had tried a traditional acquisition approach, it would have attempted to organize itself into separate program offices that coincide with each system within the program. Each program office would have individually contracted out their portion of the FCS with a prime contractor. There would have been one major integration program office to oversee the actions of all different system offices in order to ensure compliance with a system-of-systems architecture (Flood). The coordination effort would have been extremely difficult given the location and organizational boundaries existing in traditional acquisition channels. Therefore, the Army decided to utilize an LSI to perform the integration and coordination efforts needed to enforce a system-of-systems architecture. The LSI would perform managerial tasks that used to be done primarily by Government employees, such as managing the development of large systems in the FCS program, systems that would have traditionally warranted their own individual program offices (Flood).

The Coast Guard made a similar assessment of its own acquisition capabilities when deciding to use a LSI. The Deepwater program's system performance specification required a substantial number of facilities and personnel capable of handling the complex task of systems integration. Though the Coast Guard had certain facilities to handle discrete elements of the Deepwater program, it did not have the facilities, manpower or expertise to accomplish the totality of the work required (McDaniel). This assessment of current acquisition capability and manpower led the Coast Guard to contract with a private entity to handle the system integration tasks.

The Coast Guard realized that the Deepwater program's LSI would need to have access to proprietary information across the spectrum of Deepwater assets. Much of the work for the Deepwater program was being done by subcontractors. Normally, a Government entity would have to establish a contract with a private entity so that the Government could gain access to proprietary data, but the use of a LSI would establish a streamlined way of crossing organizational boundaries across the private industry. The LSI would be able to contract with subcontractors more easily than the Government would and, hence, gain access to proprietary data quickly in order to make timely decisions. Since the Coast Guard did not have an adequate number of acquisition personnel to replicate this streamlined contracting process, it chose a LSI to handle the cumbersome subcontracting process (McDaniel).

3. Encourage Competition

The emphasis placed on encouraging competition stems from the traditional practice of prime contractors picking subcontractors from their own supply pool. If the Government utilized traditional prime contracting methods for these programs, then the prime contractor would normally pick subcontractors from their own supply pools without developing a plan for encouraging competition. The Government traditionally never became involved with subcontractor selection because its contract was solely with the prime contractor. This practice is questionable when many of the subcontractors will be providing the majority of the products for the system. The Army set up the program so it would have more influence over the LSI's selection of subcontractors (Francis, "Role of the Lead Systems Integrator"). The contract essentially mandates competition in the tiers of contractors below the LSI. The Army maintained decision-making authority as to which subcontractors will be selected and could determine if competition exists. This safeguard provided the Army with visibility of the contractors in lower tiers. This visibility, in turn, provided the Army with a management capability to ensure that interoperability and commonality existed amongst all subsystems in FCS.

Coast Guard acquisition officials discussed the possibility of awarding a contract to one entity for the responsibility of systems integration and awarding separate contracts for the development and production of individual assets. However, this method was seen as a violation of the limited competition authority of the Coast Guard; therefore, the option was eliminated from consideration (McDaniel). The Coast Guard wanted to encourage competition in the Deepwater program and not limit it through the long Government contracting process. Giving the systems integrator the contractual power to subcontract with other private-sector entities for development and production of the Deepwater assets was seen as an ideal solution to encourage competition in the private sector.

F. SOCIOLOGICAL ANALYSIS

It is important to analyze the relationship between the LSI and the Government within a social context, as the LSI takes on responsibilities that used to be the sole domain of the Government. Principal-Agent Theory, or Organizational Conflicts of Interest, (Guttman 297) are social aspects inherent in the LSI concept that can be detrimental to Government interests.

Organizational Conflict of Interest (OCI), also known as Principal-Agent Theory (PAT), is a situation in which entities act in two or more roles that are at odds with each other. The LSI is a for-profit corporation that is taking on inherently governmental functions and integrating technologies from additional corporations. The central dilemma of the Government (the principal) is how to get the LSI (the agent) to act in its best interest, despite the fact that the LSI holds an informational advantage. The LSI (the agent) is tasked with managing information and people while providing the Government (the principal) with the best value—yet, the agent's interests are different from the principal's. The LSI's corporate interest manifests itself in profit-driven goals. Thus, the LSI's dual role as program manager and employed contractor for the Government can result in an OCI. If the agent's best interests are not in line with the principal's, there can be no guarantee that an OCI will not adversely affect the program. An additional concern that may arise out of an OCI is that the LSI's presence may be seen as a threat to potential subcontractors' proprietary information. Subcontractors may be unwilling to accept the risk of giving up proprietary information to an LSI who has inherently governmental authority.

Information integrity is a key consideration that arises from OCI. It can have far-reaching implications by altering the Government's decision-making. Information integrity is defined as "the trustworthiness and dependability of information. More specifically, it is the accuracy, consistency and reliability of the information content, processes and systems" (Infogix 1).

As the LSI is an entity that already possesses organic OCIs based upon corporate interest, this organic OCI may cause concerns about the integrity of the information provided to the Government for decision-making. The concept of information integrity is not solely concerned with the *quality* of the information, but also with whether or not such information is unbiased, theoretically sound, and not created as a byproduct of an OCI.

Any entity that utilizes an LSI must also possess the managerial oversight resources to analyze information from the LSI and take over its functions long enough to find a replacement if necessary. This very dilemma arose in the spring of 2007 when the Coast Guard removed the LSI from its Deepwater program, only to rehire the same LSI within the month due to the lack of adequate personnel to analyze and validate all the tasks for which the LSI had been responsible. (Biesecker, Allen and Skinner)

G. CHALLENGES OF THE LSI

As discussed in Section D of this chapter, the role of the LSI as a systems integrator gives it complete information access across the entire program. This access enables the LSI to provide oversight, yet, at the same time, may also serve as a deterrent against innovation and dissuade contractors that have valuable trade practices. Along with OCI, which may prevent the Government from receiving the best value, additional concerns arise because the LSI is a private business entity that can potentially be indispensable. The three major concerns are:

- Large, private-sector entities may not be attracted to working under a LSI, as the LSI may be viewed as a direct competitor in the near future.
- The LSI holds the complete knowledge base of a Government program, making it difficult for the Government to remove the LSI due to poor performance and replace it with another corporation.
- Should the LSI run into financial difficulties that might result in the company defaulting on the contract, the Government may be forced to subsidize the contractor in order to keep a program from failing.

Implementation of an LSI is a factor that, if not handled carefully, can lead to numerous challenges in ensuring that the LSI is performing in the best interests of the

Government. The Government must initiate managerial processes to cover the substantial scope of work the LSI is intended to perform. The Government must implement procedures that would dissuade the LSI from letting an OCI affect its judgment. Such procedures can be financial incentives based on firm metrics that tie into successful performance outcomes. Other procedures can be the auditing of LSI activities by independent groups to ensure information integrity in program reporting documents. The Government must take a proactive approach in managing the LSI's activities if it expects successful results from the LSI concept.

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III. ARMY FUTURE COMBAT SYSTEMS

A. BACKGROUND

The purpose of this chapter is to provide both an in-depth explanation of the Army's FCS, including its systems and history, as well as a conceptual understanding of the Army's massive modernization program. This chapter will present background information to support an analysis of the program's use of the Lead Systems Integrator concept. To perform an objective analysis of FCS's contractual procedures, it is necessary to understand the complex characteristics of the program.

1. Concept

The FCS will change the way the Army equips itself to fight U.S. adversaries. The Army has recognized that it needs to transform itself to conduct "full spectrum operations" (Fetterman and Plushnik 7). This transformation has already begun in the modularization process of Army units into Brigade Combat Teams (BCT). The Brigade Combat Team is a brigade-sized element that has the ability to deploy with its own organic maneuver, fire support, and logistical assets in order to fight our nation's wars. The Army's FCS is the equipment portion of this transformation. It will provide networked systems that are adaptable to "traditional warfare as well as complex, irregular warfare in urban terrains, mixed terrains such as deserts and plains, and restrictive terrains such as mountains and jungles" (Fetterman and Plushnik 2). The Army describes the program as the most complex acquisition in its history because it involves developing and integrating a family of 16 different systems, including a complex information network. (Francis, "Role of the Lead Systems Integrator")

2. History of the Future Combat Systems

The Army's FCS stems from the original initiative of former Army Chief of Staff General Eric Shinseki in 1999. He outlined his vision for transforming the Army forces into more lightweight, lethal and survivable units capable of performing full-spectrum operations by 2010. General Shinseki termed this initiative “Objective Force,” and the immediate interim solution became the Stryker BCT. (Flood) The Stryker BCT was a near-term solution force in lieu of the overall vision of the Future Combat Systems. The Stryker BCT is a unit based around the Stryker family of vehicles, lightly armored combat vehicles that are intended to move troops around the battlefield securely. This interim solution would set the requirements for a common chassis vehicle that was deployable from a C-130 aircraft, a requirement that would later be applied to all manned ground vehicles in the FCS program.

General Shinseki’s Objective Force evolved into the Army’s Future Combat Systems. The Army and the DoD’s central research and development agency, Defense Advanced Research Projects Agency (DARPA), developed a partnership in 2000 for the purposes of developing the FCS concept. The Army and DARPA evaluated four contractor teams’ Army FCS conceptual design for applicability with General Shinseki’s Objective Force vision. The results of these four teams’ studies were analyzed and developed into FCS component systems.

B. FUTURE COMBAT SYSTEMS

FCS consists of numerous manned and unmanned ground vehicular weapon systems, unmanned aerial vehicles, sensors, and a complex network through which all of these systems will interact. The benefit of the complex communication network is that all members of the network have access to information when they need it and can change their course of action as the situation evolves. This gives battle commanders accurate situational awareness to make better decisions regarding their battle tactics and leaders the edge in making decisive strikes to win battles. The current configuration of the FCS system has 14 individually manned and unmanned systems within the network. The Soldier and the communication network are considered to be two additional systems; thus, it is dubbed “14+1+1” (Fetterman). Figure 1 shows all the systems in the FCS.

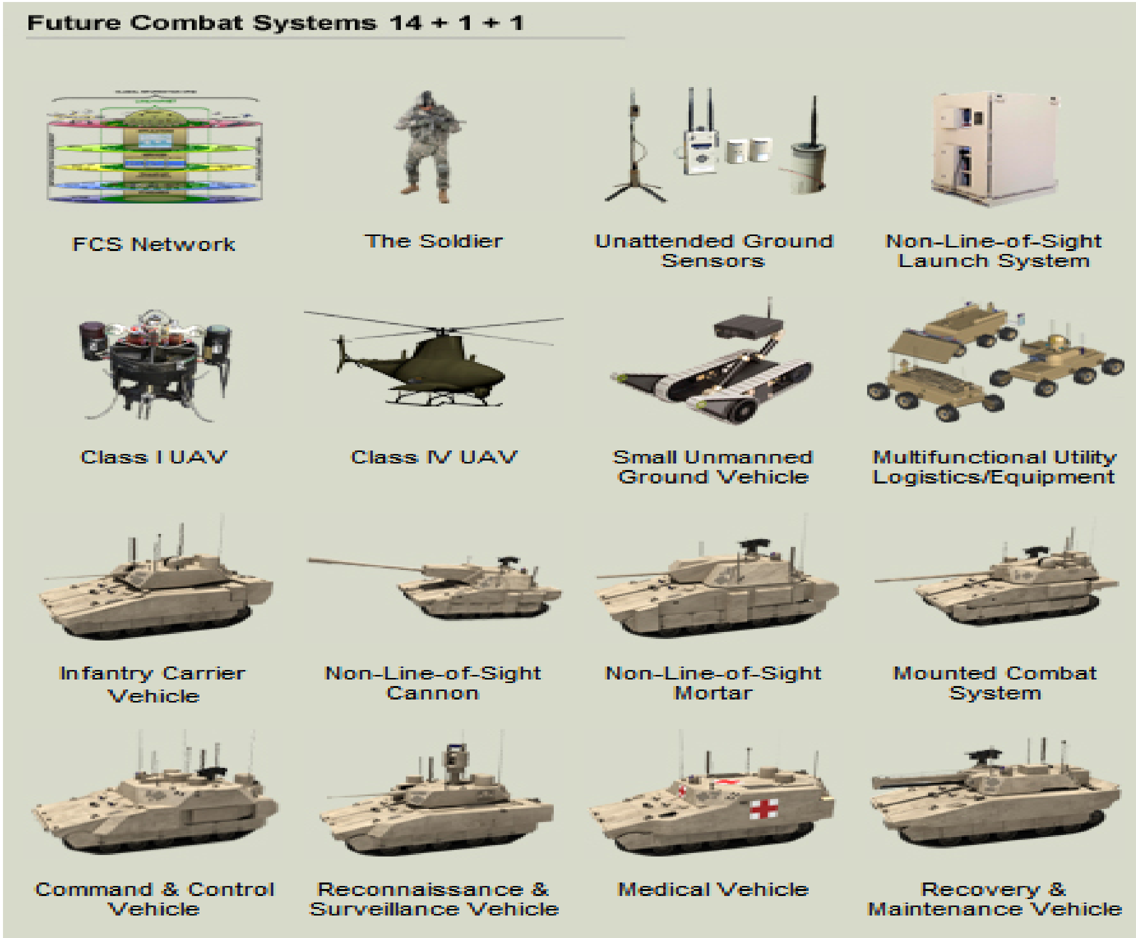

Figure 1. FCS Systems
(From Fetterman)

1. The Soldier

The Soldier is an essential part of the FCS and is treated as a discrete system within the program. The design and implementation of both the different platforms and communication architecture of the FCS are centered on the Soldiers' ability to operate the numerous FCS systems.

2. Communications

Communications have always played a vital role in military engagements. Knowledge of enemy-friendly locations and activities, combined with the ability to command and control, can enable the commander to shift resources and firepower when needed at critical points in the battle. The Army's FCS network consists of five layers that provide an integrated platform the commander can use: standards layer, transport layer, services layer, applications layer, and networked logistics systems (Department of the Army, "Network"). Figure 2 contains an illustrative description of the FCS network.

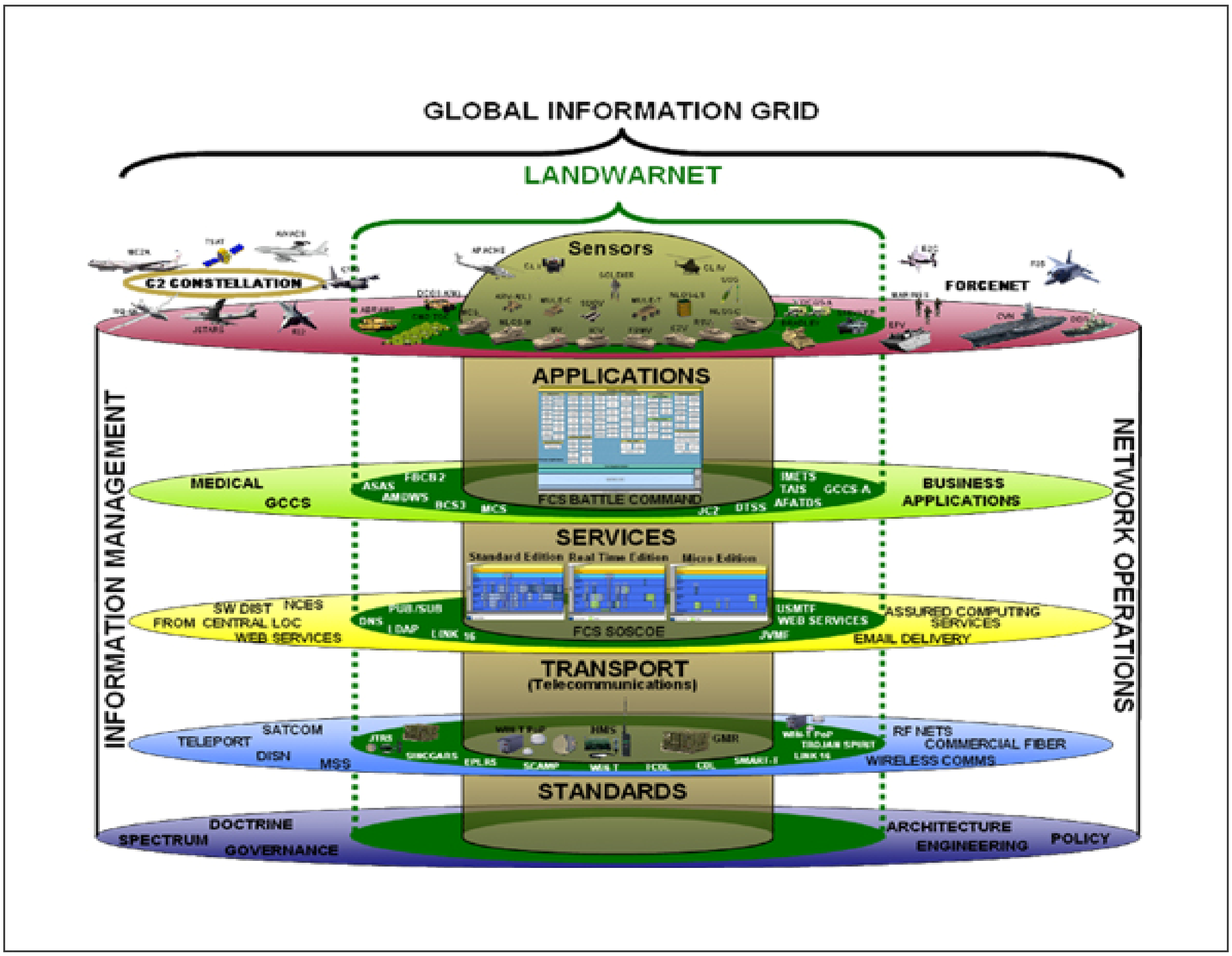

Figure 2. FCS Network (From Department of the Army, "Network")

The base layer of the FCS network is the Standards Layer, the key feature of which is that it allows interoperability between all other users. A simple analogy for this is the computer: There are many different types of computers running on different types of hardware and operating systems. If an operator wants these different types of computer systems to be able to talk to one another, he needs a common interface on the network; if no such interface exists, data sent from one machine, say an Apple, could not be interpreted by a UNIX box.

The Transport Layer can receive, decrypt and then transmit information in real-time to any other node on the FCS network. This layer provides integrated security for all information within the FCS communication systems to include the Joint Tactical Radio System (JTRS) and Warfighter Information Network-Tactical (WIN-T). The Transport Layer goes further by utilizing state of the industry technology found in commercial platforms that allows for real-time responses to network failures. As the network encounters failure conditions it begins to assess its communication assets in real-time and rearrange network protocols, bandwidth, and connectivity to ensure redundant operation and network uptime. (Department of the Army, “Network”)

The third layer is the Services Layer, which acts in much the same way as an operating system. As applications are run on the network of the FCS, the third layer handles these input/output requests simultaneously—just as a web server handles multiple requests on its servers (Department of the Army, “Network”). The most critical role of this layer is the handling of different types of radio frequencies and communication services. The ability of Soldiers on the ground to be in direct communication with aircraft to request close air support can be as easy as flipping a switch.

The Applications Layer can be seen as the brains of the FCS. It provides tomorrow’s commanders with the ability to make better decisions by formulating what the best course of action would be with available resources on the battlefield in real-time. For example, the application layer can track enemy and allied forces in real-time and includes such vital information as the logistical, manpower or fire capability status of these forces. A commander could pull back battle-weakened front-line companies and replace them with fully supplied forces.

The final aspect of the FCS network is the networked logistics system, which it should be noted, is the most valuable system within the FCS as nothing like it has ever existed before. The networked logistics system allows the commander to shrink his logistical footprint by using FCS platforms as sensors and to arrange his logistical needs in a way that best suits the mission at hand. The sensors feed the network logistical information, let commanders know the location of specific line items, and helps identify specific supply shortages in order to prevent critical units from becoming non-mission-capable. (Department of the Army, "Network").

3. Unmanned Vehicles

The first echelons of unmanned aerial vehicles in the FCS program are termed Class I Unmanned Aerial Vehicles. These UAVs provide Soldiers on the ground with a valuable reconnaissance tool and target acquisition capabilities. (Department of the Army, "Class I UAV") The Class I UAVs are lightweight and easily deployable in that they do not require expert technicians or a large logistical footprint to launch and maintain. The Class I UAVs are enhanced by the fact that they could be considered "Launch and Forget" platforms in that once they are airborne, the onboard computer can take over basic decision-making abilities (such as flight patterns) and can avoid hazardous conditions while transmitting valuable information on enemy movements. (Department of the Army, "Class I UAV")

Class IV UAVs differ from Class I UAVs in that they are more robust and, as such, require a higher level of operation training and a larger footprint. Class IV UAVs are suitable for Brigade Combat Teams and have increased range and sensory ability. (Department of the Army, "Class IV UAV")

Unmanned Ground Vehicles (UGV) are similar in concept to UAVs, with the exception that they operate on land as opposed to in the air. Small Unmanned Ground

Vehicles (SUGV) can be transported by the Soldier and can perform a variety of missions, from searching buildings to clearing an area of booby traps. (Department of the Army, "SUGV")

Perhaps the most flexible UGV is the Multifunctional Utility/Logistics and Equipment (MULE). The MULE can perform a wide range of roles with different packages that can be installed by the manufacturer. The MULE can be utilized in three roles: counter-mine; reconnaissance, surveillance, and target acquisition (RST); and transport. While each role coincides with a different manufacturer's package, commonality is maintained through each variant by the Common Mobility Platform (CMP) design. The CMP is the MULEs' common design, which establishes the base platform for the system with regard to propulsion suspension and navigation capability. (Department of the Army, "SUGV")

4. Manned Ground Vehicle

The FCS program's family of manned ground vehicles includes command-and-control vehicles, medical vehicles, and infantry fighting vehicles that include both non-lines-of-sight mortar as well as artillery systems. All vehicles will share a common vehicle chassis and will have a substantial amount of common components. This commonality characteristic is intended to lower life cycle maintenance and logistics cost. The Infantry Carrier Vehicle (ICV) replaces the Army's current Bradley Fighting Vehicle. In terms of armament, the ICV carries a 30mm cannon as its primary weapon, as opposed to the Bradley Fighting Vehicle's 20mm cannon. The ICV's real difference from the Bradley Fighting Vehicle is its increased communication and network capabilities. As the ICV is an interlinked part of the FCS framework, it has a significant advantage with respect to command and control of other FCS assets. (Department of the Army, "ICV")

The Mounted Combat System (MCS) is new in that it does not have a direct predecessor. It can be thought of as a mixture of the Bradley Fighting Vehicle and the M1 Abrams tank. The MCS shares the same basic framework as the ICV, with the addition of a 120mm cannon, the same caliber as the M1 Abrams—the U.S. Army's current main battle tank. (Department of the Army, "MCS") Utilizing similar technologies on the brigade level is the Command and Control Vehicle (C2V). This vehicle, operating within a Brigade Combat Team (BCT), can deliver command-and-control capabilities to brigade-level elements. The C2V uses the same basic platform as the ICV and MCS, with slight modifications.

5. Unattended Ground Sensors

The FCS program's Unattended Ground Sensors (UGS) system is intended to perform operational tasks such as surveillance, target acquisition, situational awareness and perimeter defense. They are all network-enabled and are able to feed real time information to remote operators on the FCS Network. The two types of UGS are Tactical UGS and Urban UGS.

C. FCS CONTRACT

The FCS contract was originally an Other Transaction Authority contract awarded to the Boeing Company (Boeing) and Science Applications International Corporation (SAIC) in March 2002 for the Concept and Technology Development (CTD) Phase of the acquisition life cycle. Boeing and SAIC were designated the LSI for the program, and, initially, the LSI approach was "expected to afford opportunities to insert *leap-ahead* technology upgrades, incorporate best business practices, and to ensure an integrated effort from all concerned" (Flood 360). The contract had a price tag of $154 million and was expected to last sixteen months.

1. Other Transaction Authority

An Other Transaction Authority (OTA) contract is a contractual instrument used primarily for development of prototypes directly relevant to weapon systems (Smith, Drezner and Lachow 11). The OTA facilitates Government contractual procedures by eliminating the need for federal laws and regulations normally found in traditional Federal Acquisition Regulation (FAR) procurement contracts. Such laws and regulations tend to deter non-traditional defense contractors from entering into contractual negotiations with the Government. The intent of the OTA contract is to create a consensus between the contractor and the Government as to the applicability of these laws and regulations in the contract. The goals of the OTA contracting method are stated below.

- Improve, streamline and strengthen technology access and development programs
- Encourage open market competition and technology-driven prototype efforts
- Exploit the cost-reduction potential of innovative or commercially developed technology (Yoder 2)

In May 2003, the FCS System Development and Demonstration (SDD) phase contract was awarded to Boeing under the same OTA agreement used in the CTD phase. The SDD phase was expected to last approximately five years, until the production decision in November 2008. The cost of the FCS program at the time was estimated to be $79 billion. (Francis, “Future Combat Systems Challenges”)

The FCS program has been significantly restructured since the original SDD contract was awarded. In July 2004, the program was restructured in order to reduce the risk of an aggressive schedule and the existence of numerous immature technologies. The following summarizes the details of the FCS program restructure:

- Lengthened timeline by four years; new production decision in 2012
- FCS Spin-Outs initiated
- Increased cost of SDD contract by $6.1 billion

2. FCS Spin Outs

The Army identified several of the matured technologies developed in the FCS program as being critical to the success of the program, as well as essential to the current force. The development of these technologies was accelerated in the FCS Spin-Out in order to infuse these new developments into the current Army force earlier and, thus, enhance the Army's capabilities and test the effectiveness of these technologies. The FCS Spin-Outs will happen in three phases, each separated by two years.

- FCS Spin-out 1: Initiate testing in Fiscal Year 2008, consisting of Network Capability Integration Kits for Bradley Fighting Vehicle, M-1 Abrams battle tank, and High Mobility Multipurpose Wheeled Vehicle (HMMWV) platforms, Unattended Urban and Tactical Ground Sensors, and the Non-Line-of-Sight Launch System.
- FCS Spin-out 2: Initiate testing in Fiscal Year 2010 of the program's active vehicle protection systems and platoon- and brigade-level Unmanned Aerial Vehicles (UAV).
- FCS Spin-out 3: Initiate testing in Fiscal Year 2012 of core program events. Spin-out will consist of ground robots to complement the Small Unmanned Ground Vehicles, Class IV UAV, and Controller Unit FCS Battle Command, which is a replacement of the current Army Battle Command System. (Fetterman 5)

In April 2005, the Army was ordered by the Chief of Staff to restructure the existing OTA contract for FCS into a FAR-based contract protected by federal laws and regulations. In September, a new FAR-based cost plus fixed fee/cost plus incentive fee contract was awarded to Boeing, which retained the LSI duties (Francis, "Role of the Lead Systems Integrator")

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IV. COAST GUARD DEEPWATER PROGRAM

A. INTRODUCTION

This chapter will provide the reader with an in-depth background of the Coast Guard Integrated Deepwater System (Deepwater) program. This information is necessary to understand why the Coast Guard initiated Deepwater. The chapter will also provide insight into the Coast Guard's decision to use a LSI for this complex acquisition program.

B. THE DEEPWATER CONCEPT

The Deepwater program is designed to enhance the deepwater capabilities of the Coast Guard. These deepwater capabilities span from boats, to aircraft, to unmanned vehicles' abilities to "enforce fisheries laws, intercept drug smugglers and illegal immigrants, and conduct search and rescue missions far out at sea" (Hecker 5). The Deepwater program looks to enhance these capabilities by acquiring new equipment or remodeling or refitting existing equipment in the Coast Guard inventory. The Deepwater program is the largest acquisition program for the Coast Guard to date.

C. HISTORY OF THE DEEPWATER SYSTEM

In the early 1990s, the Coast Guard faced a significant challenge to its ability to perform its mission to protect U.S. maritime borders, particularly in further-from-shore, deepwater operations. The challenge stemmed from the Coast Guard's reliance on near-obsolete equipment and technologies to perform deepwater missions. This equipment consisted of deepwater cutters, aircraft, and command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) assets. Most of these assets relied on antiquated technology and were reaching the later years of their service life.

The deepwater cutters had been in service for more than thirty years and were so antiquated that system and component manufacturers had cancelled the production and repair of equipment and parts for the cutters. The age and design of the cutters have prevented the integration of current technologies that automate shipboard systems and minimize maintenance. The maintenance challenges of the cutters have increased associated operations and support costs and, consequently, have reduced operational availability of the cutters.

The Coast Guard aircraft were limited in performance given their inadequate night operations capability and sensor equipment. There was also poor interoperability between the aircraft and cutters, which left each platform to perform without the support of the other. The C4ISR capability was limited due to inadequate communication and an inability to implement technological advances onto existing platforms.

The Deepwater program was initiated in 1997, and after exhaustive analysis of current assets by the Coast Guard and private contractors, the following systems were identified for procurement under the Deepwater program.

Ships, boats, and surface craft:

- 8 new National Security Cutters, or NSCs, displacing about 4,000 tons each (i.e., ships analogous to today's high-endurance cutters)
- 25 new Offshore Patrol Cutters, or OPCs, displacing about 3,200 tons each (i.e., ships analogous to today's medium-endurance cutters)
- 58 new Fast-Response Cutters (FRCs), displacing 200 tons each
- 33 new Long-range Interceptor (LRI) craft, displacing 15 tons each
- 91 new Short-range Prosecutor (SRP) craft, displacing 9 tons each.

Aircraft:

- 6 missionized HC-130J and 16 converted HC-130H Long-range Search (LRS) aircraft
- 36 new HC-144A Medium-range Surveillance (MRS) Maritime Patrol Aircraft based on the European Aeronautic Defence and Space Company

(EADS) CASA HC-235 Persuader MPA aircraft design

- 42 converted HH-60J Medium-range Recovery (MRR) helicopters
- 95 converted HH-65C Multi-mission Cutter Helicopters (MCHs)

Unmanned Aerial Vehicles (UAVs)

- 45 new HV911 Vertical Takeoff and Landing UAVs (VUAV)
- 4 leased RQ-4A Global Hawk High Altitude Endurance UAVs (HAEUAVs) (O'Rourke 5)

In addition to these systems, the Deepwater program also includes the conversion of 49 Island-class patrol boats to be upgraded from 100 ft to 123 ft in order to remain in service until Deepwater is complete.

Indeed, the Deepwater program is much like the Army's FCS in that it is keeping with the historical strategy of western warfare to fully utilize science and technology to enhance our military's fighting power. Deepwater facilitates the Coast Guard's natural evolution with the latest information technology and weapons platforms to perform its various missions in defense of the United States. Figure 3 illustrates the Coast Guard Deepwater system.

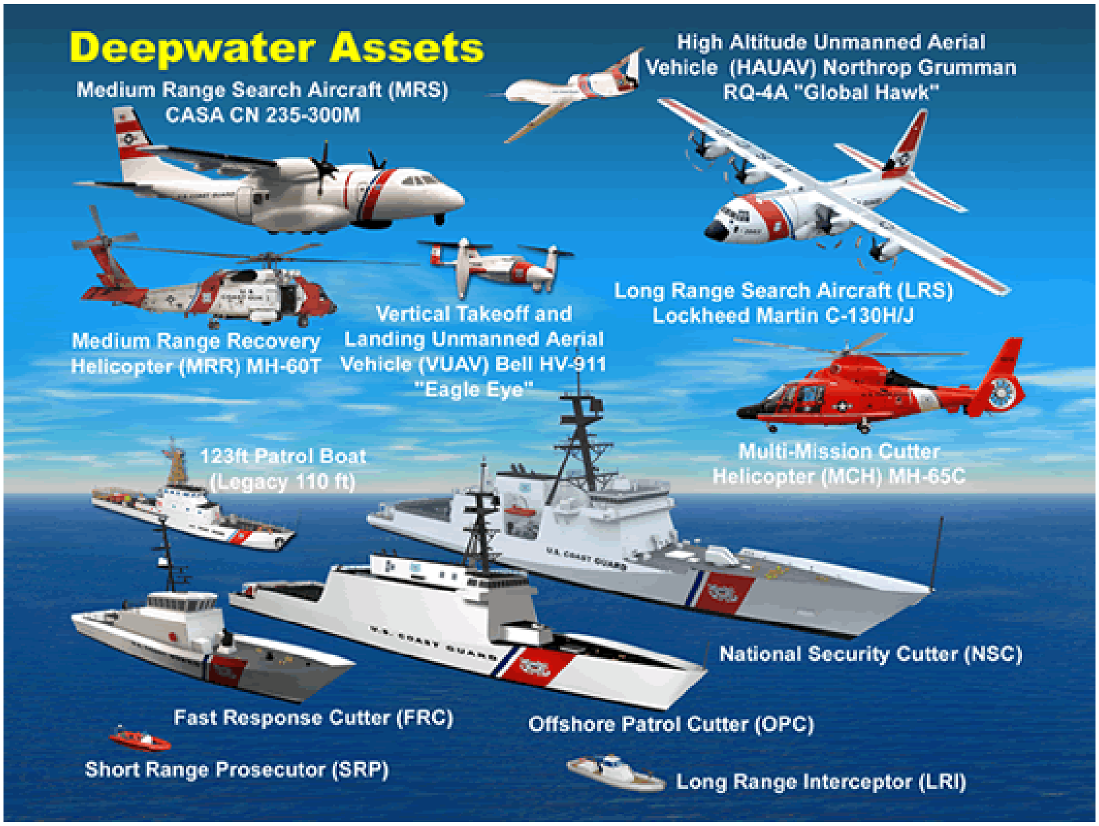

Figure 3. Deepwater Systems
(From Integrated Coast Guard Systems 1)

D. DEEPWATER SYSTEMS

1. National Security Cutter

The largest-scale vessel in Figure 3 is the National Security Cutter (NSC). The NSC is an integral component of the Deepwater system, with capabilities far surpassing those of its predecessors. The program includes eight Legend-class cutters to replace the Coast Guard's aging fleet of Hamilton-class cutters. The new NSC is 125.3m long (10.3m longer than its predecessor) and has a range of 22,000km with a sustained duration of 60 days (Glassborow). The NSC also features a wide array of sensors capable of detecting chemical, biological, and radiological hazards. It is further enhanced by its capability to support HH-60 helicopters and a stern launch for small boats, enabling the

NSC to insert teams when necessary. The NSC is not without its own offensive capabilities, armed with a MK 110 57mm gun, which was selected in order to maintain commonality with U.S. Navy weapon systems. (Glassborow) These integrated systems and unique command-and-control capabilities make the NCS a key component of the Deepwater system.

2. Fast Response Cutter

The Fast-Response Cutter (FRC) is the next lower echelon of cutters that are to replace the Island Class of cutters. The FRC features one 25mm stabilized gun with infrared sensors and four 12.7mm machine guns with a range of ten nautical miles—all powered by two 3,650-horsepower diesel engines. The FRC also possesses the ability to launch a Short-range Interceptor vessel (SRI). (Jane's Information Group 19 June 2007)

3. Aviation

As mentioned previously, one of the greatest assets of the Coast Guard is its aviation equipment. When aviation was introduced to the Coast Guard, it greatly aided search-and-rescue missions. Lately, aviation has played critical roles in drug interdiction, reconnaissance, and the neutralization of a variety of threats in our nation’s water ways. The aviation assets of the Coast Guard have been further enhanced by the Deepwater program. One of the Deepwater systems is an integrated vertical takeoff UAV system that can be launched from sea-borne platforms.

At the heart of the Deepwater system aviation is the HC-144A, otherwise known as the Medium-range Surveillance Maritime Patrol Aircraft (MRS). The MRS’s features include the EADS CASA Fully Integrated Tactical System (FITS) that enables the aircraft to use the system-of-systems network within the Deepwater framework. Additional MRS features include a multiple-mode radar search system, infrared sensors, and larger observation windows. This vast array of sensory technology serves as the eyes of the Coast Guard fleet; by feeding valuable information through its FITS in nearly all possible weather conditions, the Coast Guard is able to carry out its missions 365 days a year. The MRS can also be easily reconfigured (due to its modular design) to serve as either a personnel or a cargo transport. (Jane's Information Group) These additional configurations allow the HC-144A to play key roles as situations change; for instance, it can provide relief aid to hurricane victims and enable the quick evacuation of civilian personnel in the event of a major catastrophe.

The second major aviation asset to the Deepwater system is the Multi-mission Cutter helicopter (MCH), designated MH-65C. The MCH may be seen as the workhorse of Coast Guard operations. Its vertical take-off and landing capability provides quick response times to search-and-rescue operations or drug or terrorist interdiction. The MCH has a range of 400 nautical miles, with a top speed of 160 knots and an endurance of four hours. Its crew consists of two officers and one enlisted personnel. The weapon system on this platform consists of .50 caliber precision fire weapons and a M242 .60 caliber machine gun (Truver and Bull).

4. Unmanned Aerial Vehicles

The purpose of the VUAV, the smaller class of UAV in the Deepwater program, is to receive Chemical, Biological, Radiological, Nuclear and Explosive Detection and Defense (CBR D&D) information in order to allow increased detection and monitoring capability. The VUAV is designed to launch from the Deepwater cutters' flight deck. The VUAV radar can operate in air-to-air and air-to-surface modes to allow for increased awareness in the Coast Guard's Common Operational Picture (COP) (Tousley).

The HAEUAV is a leased system that will incorporate a sophisticated suite of radars and infrared cameras to improve the Coast Guard's COP. It is a larger UAV than the VUAV, with a more complex sensor capability (Tousley).

E. DEEPWATER CONTRACT

In August 1998, the Coast Guard awarded three $1 million dollar contracts to three teams of contractors for the concept development phase of the Deepwater program. Similar to the Army with the FCS program, the Coast Guard relied on private industry to develop the solution for its Deepwater capability needs. Based on an evaluation of all contractors' designs for the Deepwater program, the Coast Guard selected one contractor team to proceed to the second phase of the acquisition process.

In June 2002, the Coast Guard awarded the Deepwater contract to the joint venture team Integrated Coast Guard Systems (ICGS). ICGS is a teaming of two major defense contractor firms: Lockheed Martin and Northrup Grumman. The contract was originally established for five-year terms; at an estimated cost of $14 billion, the entire program would have taken twenty years to complete. (Woods) This contract was for the program's second phase of the acquisition cycle, which is similar to the DoD's understanding of the development and production phases of a program. The terms of the contract dictated that the program must come under review and re-competition every five years. The contract itself was an indefinite delivery/indefinite quantity, cost plus award fee contract with award fees every five years throughout the life of the contract. (Caldwell)

Since Coast Guard leadership awarded the contract to ICGS, Deepwater has undergone significant changes and experienced certain drawbacks in the areas of cost, schedule and performance. The most significant of these changes came after the September 11, 2001 attacks, when the Coast Guard took on additional homeland security missions and, therefore, had to revise the Deepwater contract to reflect these missions (Caldwell 84). In March 2005, the effects of the Coast Guard's increased responsibilities led to an increase in the estimated cost of the program, from $14 to $24 billion, and extended the program from 20 to 25 years. The majority of the cost increase was due to changes in the original mission requirements for the Deepwater program, adding capability to the original Deepwater assets to reflect additional Homeland Security missions. This revision to the Deepwater program led to increased scrutiny of the management of the program by Congressional agencies concerned about the increased costs and the effectiveness of the acquisition approach chosen by the Coast Guard (O'Rourke).

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V. LEAD SYSTEMS INTEGRATOR IMPLEMENTATION

A. INTRODUCTION

The authority of the LSI is considerable within the scope of the FCS and Deepwater programs. The second chapter addressed the importance of information integrity, potential OCIs, and how the LSI may exercise its authority in opposition to the Government's interests. Subcontractor management practices and the Integrated Product Team (IPT) managerial structure of the FCS and Deepwater contracts show the amount of authority the Government gives the LSIs in each program. The consequences of ceding this authority to the LSI can be measured by the cost, schedule and performance metrics of the programs. This chapter provides the contractual statements that outline the managerial power of the LSI and summarizes cost, schedule and performance metrics that can measure the effectiveness of a LSI.

B. INTEGRATED PRODUCT TEAMS

The main managerial method used in the Government acquisition force today is the Integrated Product and Process Development (IPPD). A definition of IPPD is provided by the Defense Acquisition University:

> A management technique that simultaneously integrates all essential acquisition activities through the use of multidisciplinary teams to optimize the design, manufacturing, and supportability processes. IPPD facilitates meeting cost and performance objectives from product concept through production, including field support. One of the key IPPD tenets is multidisciplinary teamwork through Integrated Product Teams (IPTs). (Defense Acquisition University 1)

The FCS and Deepwater contracts address the use of IPTs and describe both the managerial structure of the programs and how the LSI will operate within that structure.

The following statement from the FCS contract establishes the authority held by a LSI as a Program Manager (PM) in the IPPD process: "The LSI will lead each IPT, regardless of IPT level, with the Government providing appropriate co-leaders unless the

PM, UA and the PM, LSI agree otherwise" (Walter 62). The PM Unit of Action (UA) is the Government program manager established to ensure that all key Government stakeholders are represented within the IPT where appropriate. The PM LSI is the Boeing Program Manager that exercises system integration responsibilities and represents the LSI in each IPT.

This structure of IPT leadership—with the LSI as the leader of the IPT and also as a member—makes for possible conflicts of interest. The previously quoted passage can be interpreted to mean that the LSI is over-represented in the IPPD process. The authority delegated to the LSI is further delineated in the "IPT Resolution" process portions of the contract, where it states: "The final decision-making authority for an issue raised by this procedure will be the Program Manager, LSI" (Walter 63).

Similarly, the Deepwater contract also gives managerial authority to the LSI, ICGS. The following quote was taken from the Deepwater contract in reference to the conduct of IPPD within the program: "The Contractor's team members shall be delegated the responsibility, authority, and accountability for decision-making and management actions necessary, at the most appropriate location, for successful performance of the contract" (U.S. Coast Guard 38-7).

The IPT managerial structure is further delineated by the following contract statement: "The Contractor shall provide overall direction and guidance, track progress and status, resolve conflicts, and integrate products and services provided by subcontractors/vendors with the products and services provided by the Contractor" (U.S. Coast Guard 38-7).

Consequently, as a result of this managerial structure, some concerns and conflicts involving subcontractors may not reach the Government. The IPT structure was not set up to allow the entity providing the capability to voice his or her concerns, but, rather, to allow the LSI contractor to be a filter for these concerns.

C. SUBCONTRACTOR MANAGEMENT

One LSI responsibility in the FCS and Deepwater programs is subcontractor management. The LSI, ideally, does not perform much of the work in the program on its own, but manages the work of the subcontractors in order to ensure proper integration. The contracts for both Deepwater and FCS give the LSI significant power over its subcontractors and limit the Government's power to influence subcontractor decisions.

The managerial structure outlined in the FCS contract relies heavily on the LSI to provide management and leadership for the program. The Government does assert its influence on managerial decisions by mandating that co-chairs for the IPTs must be strictly Government personnel. However, the Government loses the ability to influence the program because of the restriction placed on the interaction with Boeing's subcontractors. The contract dictates: "The parties agree that Government members of an IPT do not have the authority to, and therefore shall not, direct the efforts of Boeing subcontractors, regardless of tier" (Walter 62).

The FCS contract is structured so that the subcontractors do the majority of the work for the program. The LSI holds only a managerial role in the program. Therefore, performance decisions in the IPTs should be focused on the performance of the subcontractors. These subcontractors are not required to consider the recommendations of Government representatives in the IPTs. The LSI is the only managing body that has influential power over the subcontractors; therefore, it is the only entity with influence over program performance.

The FCS contract addresses the possibility of conflicts of interests with the LSI and what measures are in place to mitigate these potential conflicts. The contract states that the LSI is not permitted to compete for any work under the contract at any tier. (Walter 64) It maintains that the LSI should not have any advantage in source selection, with the potential of awarding a contract to itself. The contract also states that the LSI will enter into written agreements with subcontractors regarding the disclosure of proprietary information. (Walter 65) One key aspect that does not comply with these conflict of interest statements is the aspect of the FCS program that applies to all systems:

the network. Boeing does have the responsibility for developing the FCS network. The breadth of the work for the FCS network is software-intensive and involves interfacing with multiple systems that the subcontractors, not the LSI, are developing. This could potentially create a conflict of interest because Boeing can use the proprietary information in the software code for the systems to build the network (Walter). The conflicts of interests clause works to prevent the LSI from awarding subcontracts to itself and to protect proprietary information of the subcontractor. However, the actual implementation of the FCS network aspect of the program proves quite the opposite.

The Deepwater contract allows Government surveillance of subcontractor activities in order for the Coast Guard to assess performance and to ensure that the objectives of the program are being met (U.S. Coast Guard, 10). The Government plays more of an active role in contract quality assurance in the Deepwater program than in the FCS contract. This active role ensures that the subcontractors do not remain solely under the control of the LSI, and the Government has more access to the actions and progress of the subcontractors. However, the ineffectiveness of this contractual language is evident in the recent performance shortfalls in Deepwater.

In a scathing 2007 report to Congress regarding the Coast Guard's Deepwater program, one researcher found that the Coast Guard did not possess the needed acquisition personnel or experience to manage Deepwater.

> Observers have also expressed concern that the Coast Guard does not have enough in-house staff and in-house expertise in areas such as program management, financial management, and system integration, to properly oversee and manage an acquisition effort as large and complex as the Deepwater program. (O'Rourke 11)

The Coast Guard could not successfully oversee an LSI without changes in its acquisition practices, organizational structure, management, and decision-making processes. (O'Rourke) Instead of keeping informed of the subcontractors' progress and performance, the Coast Guard chose to delegate this role to the LSI. "Conversely, the Coast Guard chose to limit the technical oversight role of the Systems Directorate on

Deepwater to providing ‘expertise and credible advice in core integrated engineering and logistics competencies’.” (O'Rourke 44)

D. COST

As both programs have progressed in the development phase of their contracts, their costs have risen at alarming rates. Certain aspects of these cost increases can be attributed to mismanagement. One of the key aspects of program management is managing any costs to the Government. Since the LSI holds significant management authority for each program, the considerable cost increases in the program could be attributed to its managerial ineffectiveness in cost control.

The NSC is an example of a project within Deepwater that has had a considerable cost increase, nearly 50 percent. The original cost estimate for the NSC was $775 million; however, this figure is expected to increase to as much as $1.07 billion due to structural deficiencies in the design of the NSC. (O'Rourke 17) These structural deficiencies were not detected in the IPT led by the LSI, due in large part to the inability of the IPT to collaborate and finalize engineering change proposals. (Caldwell)

The VUAV was scheduled for delivery in 2013. However, the Coast Guard has issued the contractor a stop-work order for the VUAV due to the immaturity of the system’s technology. (Caldwell) The total cost of the VUAV was estimated at $503.3 million. This cost will now likely increase when the stop-work order is cancelled or an alternative approach to the VUAV capability is pursued in the future. The IPT failed to provide a proper assessment of the system’s technology in order for the Coast Guard to make adequate funding decisions for the project. The LSI is the IPT leader, and the LSI’s inability to assess a project’s technology is a clear sign of poor managerial skills.

The total cost of Deepwater is now estimated at $24 billion, a substantial increase over the original estimate of $17 billion made in 2003. The Coast Guard contends that the majority of this increase is due to the expanded responsibilities placed on its Deepwater capabilities within its recent re-alignment under the DHS from the Department of Transportation (DT). (Caldwell) This statement may be accurate; however, the distribution of those funds within ICGS raises concerns about the LSI cost-control methods. An important factor in controlling an acquisition program's cost is the existence of competition. One of the most important tests for reasonableness when considering the cost of a contract is competition.

The previous chapter explained that one of the reasons for choosing an LSI would be to take advantage of private industry competition. The Coast Guard fully intended for the LSI to control costs by encouraging fair and open competition. However, the LSI awarded a substantial portion of the work to itself. The power given to the LSI in the Deepwater contract allowed the LSI to conduct the "make vs. buy" decisions without the input of the Coast Guard. Coast Guard officials said that the systems integrator was hired to make those decisions because the service lacked the expertise to make it. (Woods)

The following charts depict the amount of obligated funds the LSI (first-tier subcontractor) has given to itself or ICGS affiliated companies in the Deepwater program.

First-tier subcontractors	In-house work (including affiliates) for September 2003-December 2006	Previously reported percentage of in-house work, as of September 30, 2003[a]
Lockheed Martin	42%	42%
Northrop Grumman Ship Systems	64%	51%
Lockheed Martin and Northrop Grumman Ship Systems	50%	45%

Figure 4. Breakdown of the Percentage of ICGS Obligations to First-tier Subcontractors (Includes Planned Subcontractors)

(Walker 50)

According to this figure, approximately 50 percent of all Deepwater funds have gone to ICGS. As of December 2006, the total amount of funds obligated to the program was $1.6 billion. The excessive amount of work that the LSI has not subcontracted out calls into question the methods the LSI used to ensure that private industry competition provided the best value for the customer.

The current contract the Army has with the LSI is for the SDD phase of the FCS program. It is estimated at $17.5 billion and is a cost-plus-fixed-fee and cost-plus-incentive-fee contract. The fee structure of the contract allows for the LSI to earn a substantial portion of its fees prior to capability demonstration of the FCS program. The fixed fee is paid to the LSI for successful completion of an event. The purpose of the incentive fee is to reward the LSI for achieving cost control and performance goals tied to that event.

The cost portion of the contract is approximately $15.2 billion, with the remaining 15 percent ($2.3 billion) consisting of incentive and fixed fees. These fees can be 80-percent realized by the LSI by the Critical Design Review (CDR). The CDR is scheduled for 2011, and the demonstration of individual FCS prototypes and the system-of-systems will happen after the CDR (Francis, "Role of the Lead Systems Integrator"). Typically, most cost growth occurs after the CDR during performance demonstrations. The cost growth is attributed to design flaws typically being discovered in the building and testing of prototypes that normally occur after the CDR. The LSI can potentially earn about $1.84 billion in event and performance-based fees and still not demonstrate any FCS program performance. This fee structure calls to question the procedures the Army uses to incentivize the LSI for providing capability.

The compositions of the fees, as well as the events tied to them, are outlined in Figure 5.

Dollars in millions

Fiscal Year	Event	Incentive Fee	Fixed Fee	Total Fee
2005	No Event		3.4	**3.4**
2006	In-Process Preliminary Design Review (Capability Maturity 0)	101.1	191.7	**292.8**
2007	No Event		178.0	**178.0**
2008	Engineering Maturity 1	125.2	168.0	**293.2**
2009	Preliminary Design Review (Capability Maturity 1)	255.3	160.6	**415.9**
2010	Engineering Maturity 2	145.3	148.4	**293.7**
2011	Capability Maturity 2 (Critical Design Review)	317.8	129.1	**446.9**
2012	Engineering Maturity 3	59.8	76.4	**136.2**
2013	Capability Maturity 3	96.8	51.7	**148.5**
2014	Engineering Maturity 4	22.6	22.0	**44.6**
2015	Verification Complete	19.9	4.6	**24.5**
Totals		**1,143.6**	**1,133.9**	**2,277.7**

Source: U.S. Army data and GAO analysis

Figure 5. Fee Events and Schedule for FCS Contract
(Francis, From "Role of the Lead Systems Integrator" 22)

As indicated in the preceding chart, over 80 percent of the incentive and fixed fees for the FCS contract will be paid to the LSI by the CDR.

The distribution of incentive fees in the FCS program for each program event does not encourage the LSI to meet the requirements to receive those fees. The incentive fee structure allows for the unused incentive fee funds to be rolled over to subsequent events in order to use the money to incentivize the LSI. If the LSI fails to meet the cost or performance objectives of the incentive fee, then it can recoup the remaining funds later. (Francis, "Role of the Lead Systems Integrator") This undercuts the original intent of the incentive fee, which was to provide motivation for the contractor to meet cost, schedule and performance metrics tied to an event. Under this procedure, the LSI does not have to meet cost control and performance metrics for an event within a given time because it can recoup the fee later.

The initial cost estimates of the total FCS program were approximately $77.2 billion. By 2005, this cost had grown to approximately $119.2 billion, which the Army contends is due in large part to the restructuring of the FCS contract from an OTA contract to a Federal Acquisition Regulation (FAR)-based, cost-plus-fixed-fee/cost-plus-incentive-fee contract, as well as to the decision to produce certain FCS capabilities earlier in the FCS Spin-outs. However, the cost of the program continued to rise in 2006, with independent agencies estimating it to be $150.5 billion. The Army states that the total costs of the FCS program are now $163 billion. The total costs for the FCS program keep increasing as the program supposedly gets more mature; however, the LSI, thus far, is recouping most of its costs for the development phase prior to demonstrating capabilities, and is earning incentive fees for cost control, although the total costs of the program keeps rising.

E. SCHEDULE

The LSI's effectiveness can be measured in this research by cost, schedule and performance. Perhaps the most important metric with DoD and DHS programs is schedule. A high-performance, cost-effective solution will not adequately meet mission requirements if it cannot be delivered to the war fighter in a timely manner.

In October, 2007, the Deepwater program encountered a setback to its schedule with the VUAV vertical unmanned aerial vehicle. The VUAV platform's schedule was halted altogether after technology assessments concluded that the technology maturity of the VUAV was unproven (Caldwell). The original delivery year for the VUAV was 2006. However, now the Coast Guard has halted funding and all action on the VUAV until at least fiscal year 2013. This schedule change could have negative effects on the capabilities of the NSC because the VUAV was originally scheduled to be delivered with the NSC to provide surveillance capabilities. The LSI did not make an adequate assessment of the technology and has failed to set a realistic schedule to reflect the level of technology maturity in the VUAV.

The original time to delivery of the Deepwater assets was twenty years. After the Deepwater program's revision in 2005, an additional five years were added to the timetable. Much of the schedule changes in the revision are attributed to changes in the scope of requirements with the realignment of the Coast Guard under the DHS. The schedule since 2005 has continued to slip for certain assets, due in large part to inefficiencies in design and integrations. The following figure depicts the schedule status of each Deepwater asset with respect to previous year's schedule estimates.

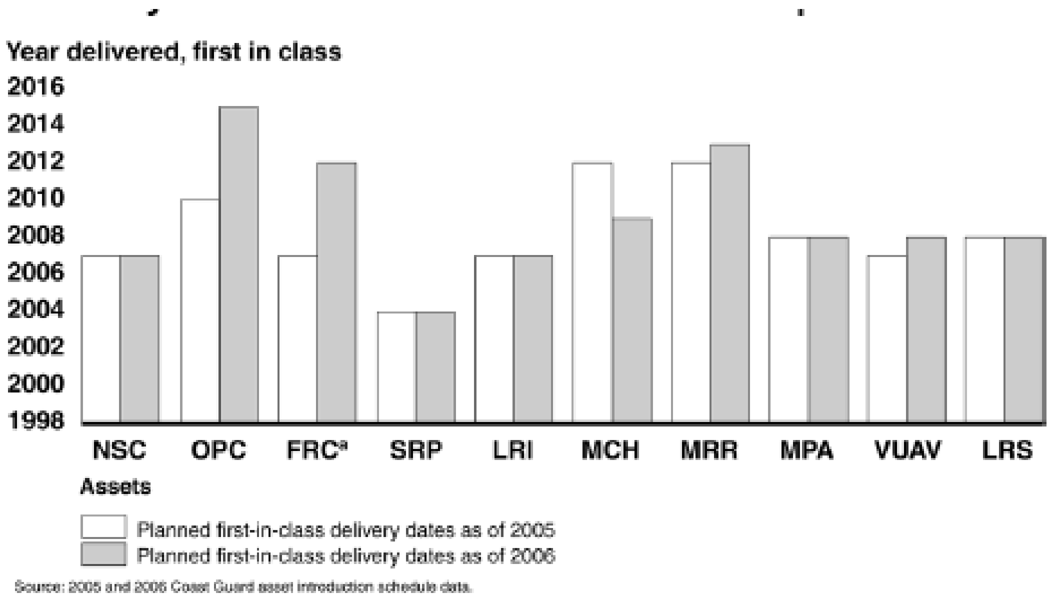

Figure 6. Comparison of 2005 and 2006 Estimated Delivery Dates for the First-in-Class Deepwater Assets

(From Caldwell 34)

According to the figure, four Deepwater assets will not make their intended first-in-class delivery date. This schedule slippage can be attributed to the LSI's poor management in the design and development of Deepwater assets. It should have little to do with the Deepwater program revision of 2005.

The schedule conflicts within the FCS program are difficult to attribute solely to the LSI because there are relatively few assets that have gone through production—and the program is still in the SDD phase, with a CDR approaching in 2011. The results of the CDR will be able to show the effectiveness of the LSI in the development of FCS. The contract restructure into a *FAR*-based contract in September 2005 can be used as an example of how ineffective the LSI was in accomplishing the goals that justified the use of an LSI in the first place.

The original schedule for the FCS program development was aggressive. The schedule called for three years in development, with production beginning in 2006 and initial operating capability being achieved in 2008. The way the Army attempted to mitigate the increased risk in the short schedule was by utilizing a LSI to infuse private-industry best-business practices into a system-of-systems acquisition. The LSI was supposed to be a partner to the Army in refining requirements and technology assessments. The LSI failed to provide the Army with the required expertise to assess the FCS suitable for entry into the SDD phase of acquisition. As a result, the Army had to restructure the program and add four additional years to the overall schedule in order to accommodate the lack of requirement definition and technology maturity. The current FCS schedule is depicted in the figure below.

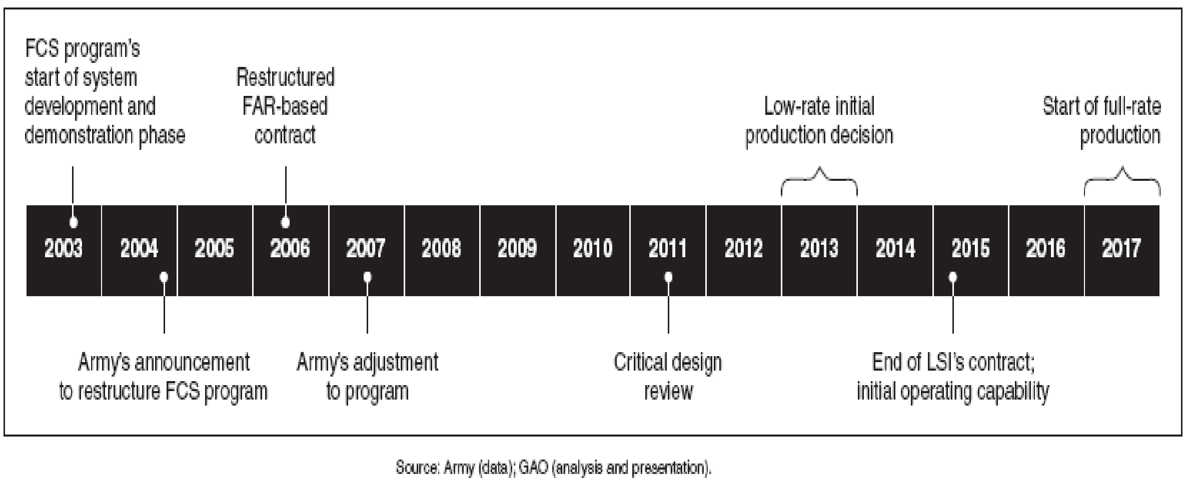

Figure 7. Key Events in FCS Program's Acquisition

(Francis, From "Role of the Lead Systems Integrator" 6)

The figure shows that the FCS program will not enter into Low-rate Initial Production until 2012, which is significantly beyond the original estimate of 2006. There are many factors that contribute to this considerable schedule increase; however, it is important to note that the reason the LSI was pursued was to help handle the initial aggressive schedule of the FCS. The LSI did not perform its duties as a program manager adequately, in that it did not advise the Army on the immaturity of technologies or the ill-defined requirements of the FCS system-of-systems architecture.

F. PERFORMANCE

The Coast Guard suffered additional schedule delays in the highly publicized NSC failures. The reason for the NSC's delay was the design flaws of the vessel. These design flaws could have been addressed in 2002 when they were first discovered, which may have enabled the program to stay on track. But failure of the LSI to properly manage these concerns has led to failure. One researcher remarks:

> The Coast Guard's technical experts first identified and presented their concerns about NSC's structural design to senior Deepwater program management in December 2002, but this did not dissuade the Coast Guard from authorizing production of the NSC in June 2004 or from awarding ICGS [the Integrated Coast Guard Systems] a contract extension in May 2006. (Fein 1)

The structural deficiencies prevented the vessel from being deployed for its required duration of 230 days in the operational environment for which it was designed. These design flaws are expected to increase the program's cost, the maintenance cost, and the subsequent lifecycle cost (O'Rourke).

The LSI's failure to meet contractual requirements by providing oversight and seamless integration of systems resulted in numerous performance issues for Deepwater. On February 10, 2006, the Department of Homeland Security received a complaint to the Inspectors General's Office alleging that the 123' Island-Class Patrol boats had numerous safety and security flaws that were being ignored by the contractor and overlooked by the LSI (O'Rourke). The complaint further stated how this individual had tried unsuccessfully for two-and-a-half years to resolve the problem by informing the contractor and bringing it to the attention of the LSI. It was clear, upon a formal review, that the contractor's failure to comply with design requirements had led to the following:

- The safety of the 123' cutter's crew was compromised by the contractor's failure to utilize low-smoke cabling.
- The contractor knowingly installed aboard the 123' cutter and prosecutor external C4ISR equipment that did not meet specific environmental requirements outlined in the Deepwater contract.
- The cable installed during the upgrade to the cutter's C4ISR system represented a security vulnerability.

- The video surveillance system installed aboard the 123’ cutter did not meet the cutter’s physical security requirements. (O’Rourke 46)

The allegations stated that the contractors knew that these shortcomings were in violation of the contract but deliberately ignored contractual language and appeals by the plaintiff citing safety concerns for the cutter’s crew. These actions have caused the 123’ Island-Class Patrol Boats project to be suspended after eight boats have been delivered. The remaining eight boats have been decommissioned, and the Fast-Response Cutter (FRC) schedule has been accelerated to fill the capability gap produced by this suspension. This performance shortfall can be attributed to the LSI not performing the necessary managerial steps in overseeing design functions.

The original Deepwater contract mandated a 20-year program that had a cost of over $17 billion dollars. After revisions to the original program schedule due to the events of September 11 and the added mission requirements placed on the Coast Guard, the Deepwater program added an additional five years to its original schedule. The original schedule has suffered many additional delays due to lack of oversight within Deepwater (such as the national security cutter, vertical take-off and landing unmanned aerial vehicles, and cutter vessels). The lack of managerial oversight and integration by the Deepwater LSI has contributed to the overall program schedule slippage and can be tied to future schedule overruns of the program.

The performance shortfalls of ICGS can be illustrated through the failures of the patrol boat modernization program as it attempted to lengthen the hull. The Deepwater program required the lengthening of the Coast Guard’s 110’ patrol boat to 123’ in order to meet its new post-9/11 requirements. The design and implementation of changes that required the cutters to meet these additional requirements was poorly managed. The patrol boats suffered numerous structural design failures that resulted in eight of the boats being decommissioned. The remaining equipment on these boats was salvaged to be used on other Coast Guard equipment (O’Rourke). The failure of the patrol boat modernization reflected the failure of the LSI to correctly manage contractors, integrate technologies, and provide the necessary oversight in a system-of-systems program. These performance shortfalls adversely affected cost, as they wasted money when the required cutters were not delivered on schedule.

The Fast Response Cutter (FRC) program was accelerated due to the failure of the patrol boat modernization design. The construction effort of the FRC was sped up by ten years. However, design features in the FRC were problematic, and the Coast Guard had to cancel the work on design. (O'Rourke) This cancellation led to the FRC being divided into an FRC-A and an FRC-B, where the B-class would be similar in design to the patrol boat, and the A-class would have a new design. The FRC-B will be built by a company that is not associated with the ICGS.

The Army and the LSI work collaboratively on refining requirements to fit within the overall performance specification of a system-of-systems. This requirements analysis has resulted in some changes to operational requirements in the FCS system. One such operational requirement is the transportability of the manned ground vehicular system. The original operational requirement mandated the weight of the FCS manned ground vehicle to be within transportability standards of a C-130 aircraft (approximately 24 tons). The requirements refinement showed that the advanced armor for the systems did not prove to be effective within the weight parameters. (Francis, "Role of the Lead Systems Integrator") The operational requirement was, consequently, altered to incorporate a 29-ton weight requirement, which changes the transportation capability to a C-17 aircraft.

The Army has absolved the LSI of many of the cost, schedule and performance shortfalls of the FCS program. The Army bears the responsibility of maturing certain technologies within the FCS program that are critical to development efforts of the LSI. The armor for the manned ground vehicle is an example of such an instance: the performance of the LSI is dependent on the individual efforts of members of the Army technology community. The nature of contract the LSI has with the Army makes it impossible to measure performance until the capability is proven, which will occur in the CDR. Until then, the LSI is required to put forth its best effort to develop the Army's needed capabilities.

The LSI in the FCS is also the second-tier contractor for the network in the FCS program. This allocation is critical due to the overarching nature of the network within the system-of systems architecture of the FCS program. The software within the network will not be tested on the full FCS system until after the production decision in 2012. Until then, the software contractors will rely heavily on modeling, simulation and single-system testing to test for effectiveness and suitability. The resolution of any design issues during the production phase can prove to be extremely costly. The LSI has the responsibility of integrating all assets of the FCS through this network. However, the lack of sufficient testing and evaluation of the network in the SDD phase of the program can ultimately lead to under-performance of the entire FCS system in the areas of net-centricity and interoperability.

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VI. CONCLUSION

A. RESEARCH QUESTIONS AND ANSWERS

The primary research question was: What is the concept of the Lead Systems Integrator?

The Lead Systems Integrator concept confers inherently governmental authority on a private-sector entity enabling it to develop and integrate system-of-systems acquisition programs.

1. Supplemental Research Questions

- How could the conceptual approach of the LSI increase the Government's probability of attaining the best value?

The conceptual approach of the LSI is intended to facilitate the acquisition of complex system-of-systems programs, specifically the systems integration aspect of a system-of-systems program. This research shows that in order to perform as a system integrator, the LSI was given inherently governmental authority that was previously unavailable to traditional prime contractors. In order to obtain the best value from the LSI, the Government needed the LSI to perform the following functions: manage the complexity of the program; resource a capability gap in acquisition resources; and implement more competitive procedures for acquiring distinct elements of each program.

- How effective was the implementation of the LSI — based upon cost, schedule, and performance?

The implementation of the LSI was clearly not effective with the Coast Guard's Deepwater program. Deepwater continues to miss schedule on four critical assets, resulting in significant cost overruns. The lack of system performance in delivered Deepwater assets has led the Coast Guard to modify its LSI approach. The Coast Guard did not exercise proper oversight of the LSI to ensure information integrity and did not implement an effective managerial structure to ensure factors such as organizational conflicts of interest did not hinder the program's progress.

The FCS program's current cost, schedule and performance metrics indicate that the LSI implementation in the program is effective. However, when put into the context of the original cost, schedule and performance goals of the program prior to its restructuring in 2004, the LSI implementation effectiveness can be questioned. The LSI was supposed to aid the Army in refining requirements and managing the cost, schedule and performance variables of the FCS program. The restructuring of the program added more cost, increased the schedule and redesigned certain performance aspects of the program. However, now the Army maintains that the program is currently on schedule and under cost, according to the restructured program variables. Even so, much of the performance of the FCS assets will not be demonstrated until after a Critical Design Review. The LSI would have been paid much of its cost and incentive fees by that time, but may not deliver a working system.

B. CONCLUSIONS

The Lead Systems Integrator concept, as it is defined in this paper, can be an unsound practice due to the conferring of inherently governmental authority to a private-sector entity without proper Government oversight. Such inherently governmental authority can be used to conduct business in a way that does not serve the best interests of the Government. There are certain responsibilities in Government acquisitions that must be kept solely governmental, and the management of cost, schedule and performance is one of those. A private-sector entity should be encouraged to manage cost, schedule and performance, but the overall responsibility for these variables should be retained by the Government. The probability of cost overruns, schedule delays, and performance shortfalls is too high if the Government lacks the capability to manage these themselves. A Lead Systems Integrator should not be pursued if current acquisition expertise in overall program management does not exist to provide oversight of the program.

C. RECOMMENDATIONS

The lessons learned by the Coast Guard should be carefully recorded to support future system-of-systems acquisition programs within the Government.

More careful thought should be given to the sociological factors of a LSI acquisition approach. The assumption that sociological factors will be eliminated by contractual language and incentives fails to take into account that the LSI may think or behave in a manner other than expected. We suggest that these sociological problems related to OCIs can be decreased by utilizing Federally Funded Research and Development Centers (FFRDC), non-profit organizations, or academic universities as LSIs. These organizations could provide the right mix between public funding and private interest in order to ensure that the Government receives the best value.

Unless the Government has sufficient resources and personnel to successfully oversee all aspects of a program's acquisition and is able to verify the validity of information garnered from the LSI, the approach should not be considered. Utilizing a LSI and ensuring the integrity of information through third-party auditing is inefficient and undermines the conceptual reasoning behind utilizing a LSI. If the Government does not have resources and personnel to provide oversight of a program, then the Government should not pursue a LSI.

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